Cardiology in the Young

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Successful catheter ablation of the accessory pathway in an unusual location in a 13-year-old girl with a coronary sinus diverticulum and Wolff-Parkinson-White syndrome

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Brief Report

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Abstract

Wolff-Parkinson-White syndrome is a congenital cardiac pre-excitation syndrome that is effectively treated by ablating the accessory pathway. However, accessory pathways located in the posteroseptal region can sometimes be challenging. In this paper, we present the successful ablation of the epicardial posteroseptal accessory pathway through the middle cardiac vein in a 13-year-old girl with a coronary sinus diverticulum and Wolff-Parkinson-White syndrome, after unsuccessful ablation attempts at different locations. If the ablation procedure fails, the possibility of the posteroseptal pathway should be kept in mind, and coronary sinus angiography should be performed. In cases with a coronary sinus diverticulum where ablation is not successful, other coronary sinus structures, for example, the middle cardiac vein should be considered as potential accessory pathways.

Wolff-Parkinson-White syndrome is a congenital cardiac pre-excitation syndrome[1] that can be effectively treated by ablating the accessory pathway. Although the acute success rate of accessory pathway ablation is generally high, accessory pathways located in the posteroseptal region can sometimes be challenging. The posteroseptal space is an anatomically complex region consisting of several structures, including the atrioventricular valves, the ostium of the coronary sinus, the middle cardiac vein, and the atrial and ventricular septa. Rarely, posteroseptal accessory pathways are found in coronary sinus anomalies, such as diverticula. The coronary sinus diverticulum can be described as a venous pouch located within the epicardial layers of the posterior superior process of the left ventricle, with a neck opening into the proximal coronary sinus.[2]

In this paper, we present the successful ablation of the posteroseptal accessory pathway through middle cardiac vein in a 13-year-old girl with a coronary sinus diverticulum and Wolff-Parkinson-White syndrome.

Case

A 13-year-old girl with Wolff-Parkinson-White syndrome was referred to our clinic. The baseline electrocardiogram showed a sinus rhythm and ventricular pre-excitation, as well as a negative delta wave in leads II, III, aVF, and V1 (Fig 1). The clinical examination and echocardiogram findings were normal. After obtaining informed consent from her family, an electrophysiological study was performed under general anaesthesia.

The electrophysiological procedure was performed using three-dimensional electroanatomic mapping system guidance (Abbott/St. Jude Medical Inc., St Paul, Minnesota, United States of America). Quadripolar catheters were placed in the right atrium and right ventricle, and a decapolar catheter was in the coronary sinus. Programmed stimulation was performed to evaluate the conduction properties of the accessory pathway and to induce tachycardia. Basic electrophysiological data revealed an A-H interval of 30 ms and an H-V interval of 15 ms. A risk assessment was performed under general anaesthesia. Orthodromic atrioventricular reciprocating tachycardia was induced and pre-excitation conduction via accessory pathway continued incrementally during adenosine administration. The accessory pathway and atrioventricular node block was 230 msn, and the accessory pathway effective refractory period was 260 msn, without sympathomimetic drugs. During the sinus rhythm with delta wave mapping, the earliest ventricular activation was found in the right posteroseptal region, and this area was marked. Radiofrequency energy was delivered to the marked area with a TactiCath™ catheter (10 seconds, 30 W energy, and 42°C temperature), but ablation was unsuccessful, and pre-excitation continued. The possibility of an epicardial accessory pathway was considered, and coronary sinus venography was performed. A coronary sinus diverticulum was identified near the middle

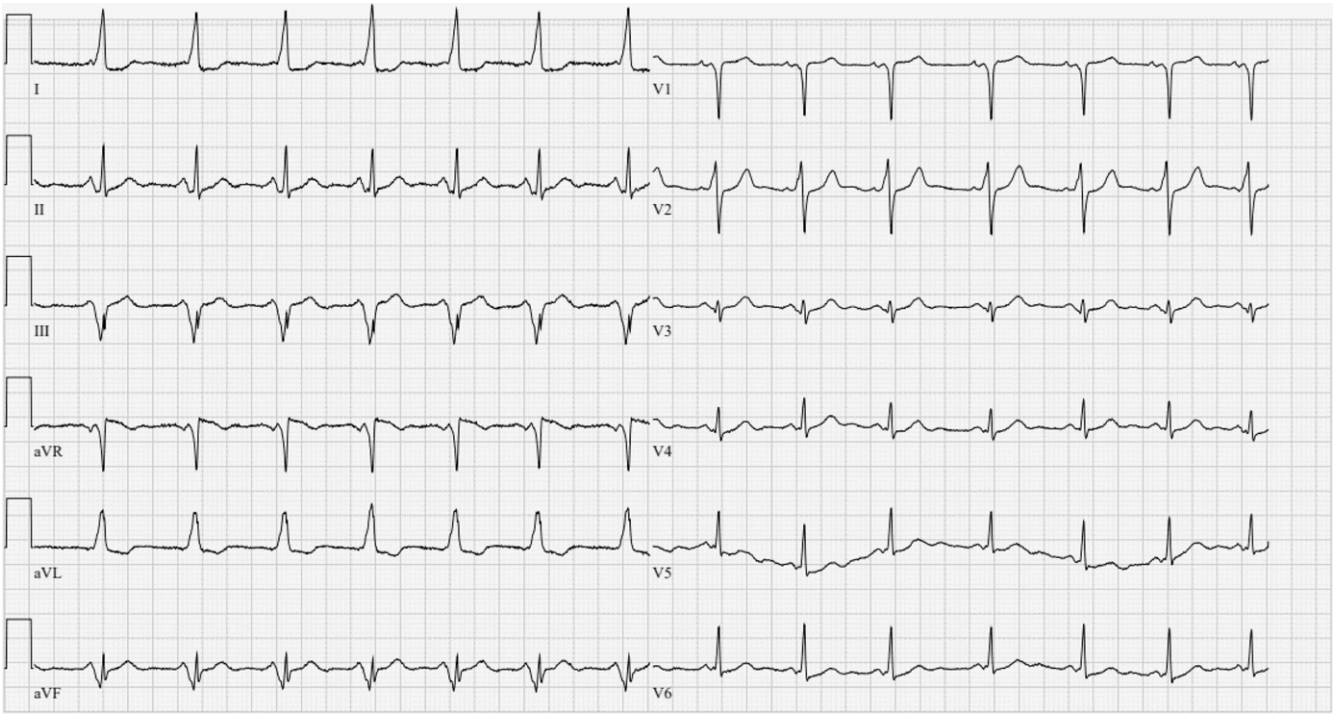

Figure 1. Electrocardiogram showing negative delta wave in leads II, III, aVF, and V1.

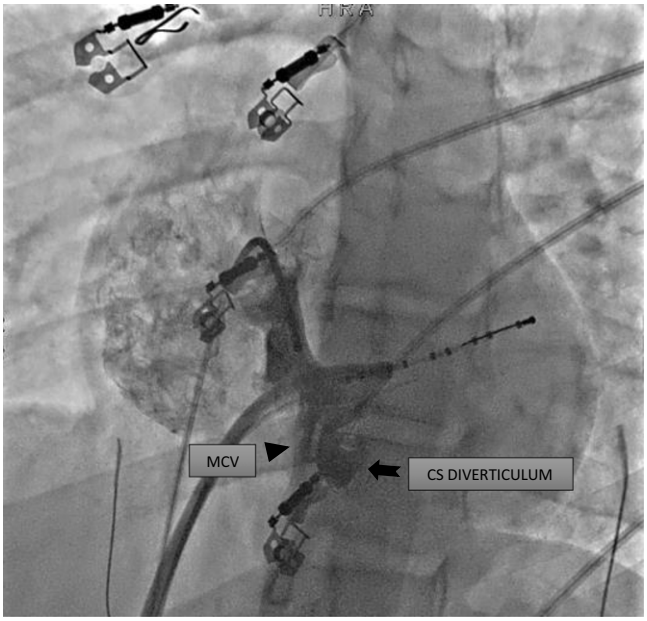

Figure 2. Coronary sinus venogram showing a diverticulum (arrow) and MCV (arrowhead).

cardiac vein (Fig 2). The electroanatomical map of the coronary sinus diverticulum was created, since the accessory pathway was most likely located at that point. The earliest ventricular activation was detected in the coronary sinus diverticulum during the sinus rhythm. Radiofrequency energy was applied at this site (10 seconds, 30 W energy, and 42°C temperature), but ablation failed again. Further mapping was performed within the middle cardiac vein, and the earliest activation area was found in this region. This time, radiofrequency ablation (60 seconds, 30 W energy, and 42°C) was performed successfully through the middle cardiac vein (Fig 3). The ablation procedure was completed with two radiofrequency lesions, confirming the disappearance of the epicardial posteroseptal accessory pathway with adenosine. Following 30 minutes of waiting time, tachycardia could not be induced, and the procedure was terminated. Delta waves were no longer visible on the resting electrocardiogram (Fig 4). The total procedure time was 180 min, and the fluoroscopy time was 12 min. The patient was monitored overnight and discharged the next day with a sinus rhythm. No complications related to the ablation procedures were reported.

Discussion

Posteroseptal accessory pathways are the second most common accessory pathways, and their ablation is associated with longer procedure times, greater fluoroscopic exposure, and more radiofrequency lesions than in any other location. Posteroseptal accessory pathway ablation can sometimes be challenging due to the complex anatomy of this region, the possible requirement of right-/left-sided mapping, epicardial connections involving the coronary venous system and diverticulum, and the risk of injury to the coronary artery.[3]

Coronary sinus anomalies are rare but seem to be a significant cause of failure in the case of the ablation of posteroseptal pathways. If such anomalies are suspected, coronary sinus angiography should be performed during the ablation procedure. The detection of coronary sinus structures by angiography can assist in the elucidation of the anatomical cause of arrhythmogenic substrates and guide catheter manipulation in searching for the target site of radiofrequency application.[4,5]

The coronary sinus has a myocardial coat with sleeve-like extensions. The extensions of this coat can connect to the ventricular epicardium through the posterior cardiac vein, middle cardiac

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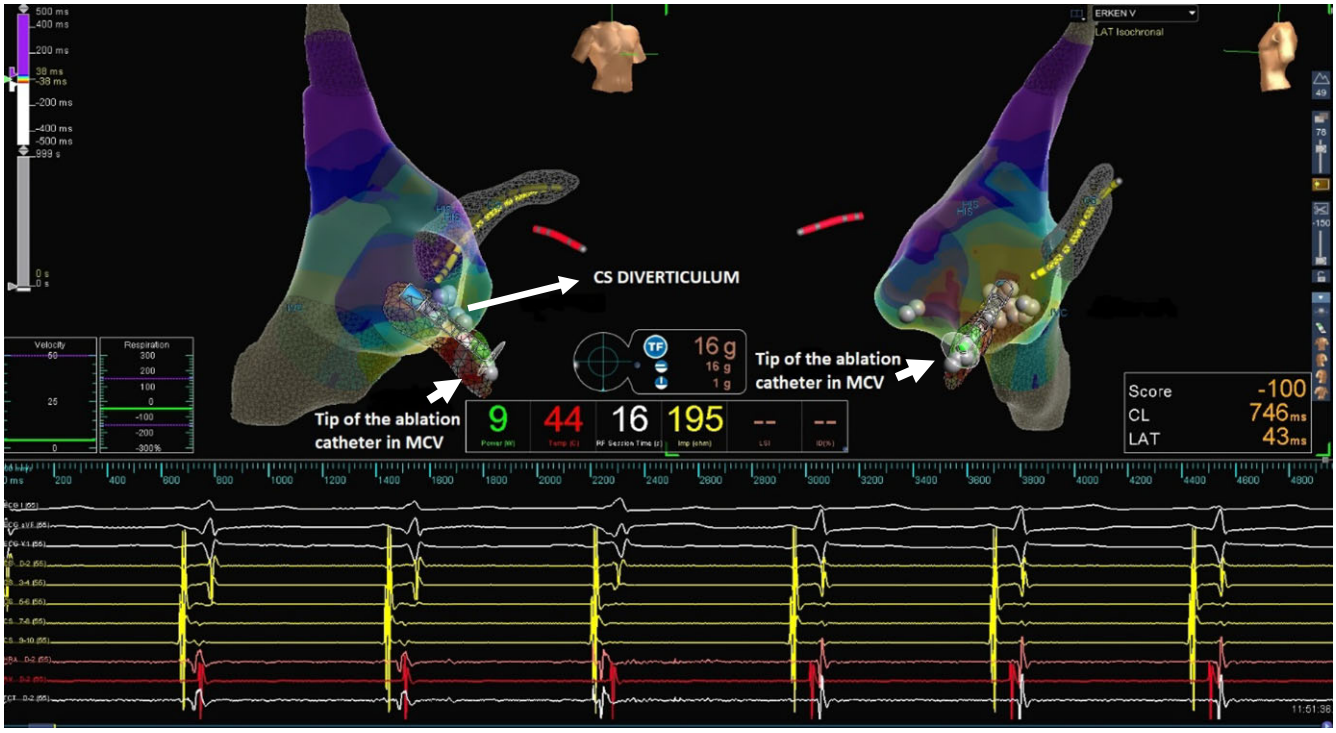

Figure 3. The disappearance of ventricular pre-excitation during RF ablation is demonstrated. The tip of the ablation catheter is shown to be in the MCV.

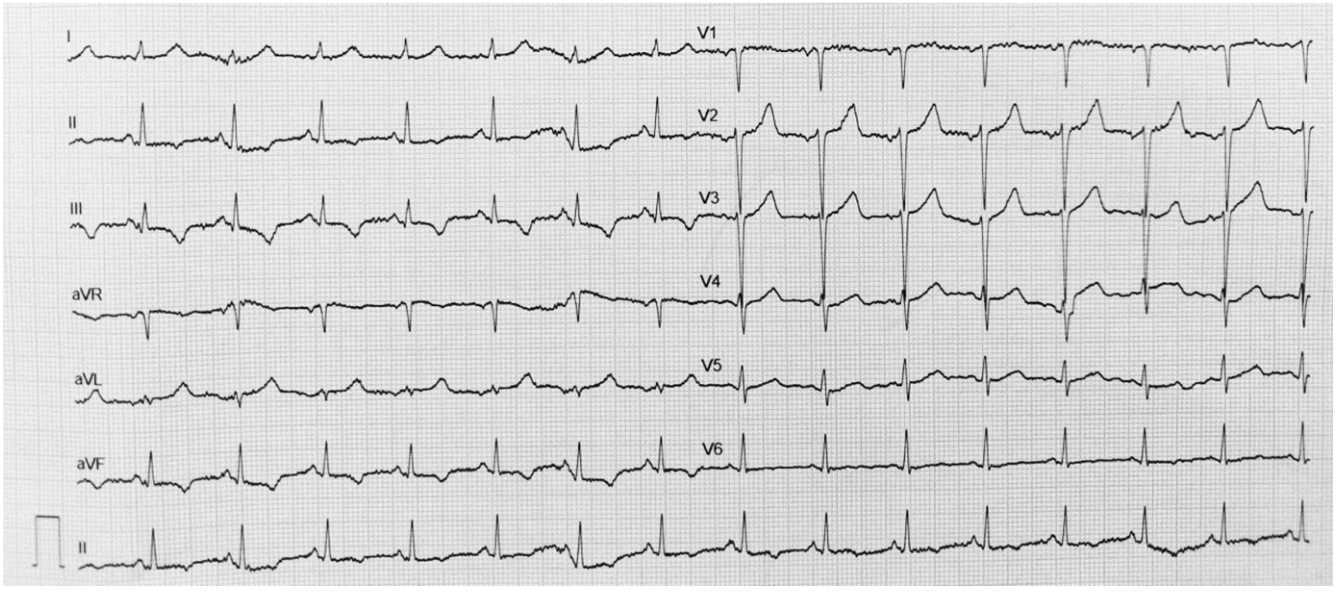

Figure 4. Delta waves were no longer visible on the rest ECG.

vein, or a diverticulum neck and form the epicardial posteroseptal and left posterior accessory pathway.[6,7] Previous studies indicate that in the presence of a coronary sinus diverticulum, the accessory pathway is likely to be in the diverticulum. However, there are also reports in which accessory pathways have been successfully ablated at sites different from the diverticulum in adult patients diagnosed with a coronary sinus diverticulum. Weiss et al[4] presented a series of nine patients with the coronary sinus diverticulum who underwent successful ablation. The accessory pathway was located within the neck of the diverticulum in seven of these patients, and on the atrial side of the posteroseptal tricuspid annulus in the remaining two. Sun et al[6] showed the presence of a coronary sinus diverticulum in 36 patients (7.5%) in a large series of 480 patients with posteroseptal or left posterior accessory pathways. In two of these patients, the accessory pathway was associated with two different anatomical structures other than the diverticulum (posterior cardiac vein and the collateral vein between the middle cardiac vein and posterior cardiac vein). These studies suggest that in the presence of a coronary sinus diverticulum, the accessory pathway is rarely found elsewhere [4,6]. In our case, the accessory pathway was found in the middle cardiac vein, although the patient had a coronary sinus diverticulum. This may be due to the

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coronary sinus myocardial coat, which has the potential to form an accessory pathway and covers the terminal part of the middle cardiac vein, as described by Sun et al.[5]

In conclusion, to our knowledge, this is the first report on a children with a coronary sinus diverticulum and Wolff-Parkinson-White syndrome who underwent successful epicardial accessory pathway ablation through a site other than the coronary sinus diverticulum. In the case of endocardial radiofrequency ablation failure, the posteroseptal pathway should be kept in mind, and coronary sinus angiography should be performed. In the presence of a coronary sinus diverticulum on angiography, the accessory pathway will likely be in that location. However, in cases with a coronary sinus diverticulum where ablation is not successful, as in our patient, other coronary sinus structures, for example, the middle cardiac vein should be considered as potential accessory pathways.

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Conflicts of interest. None.

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